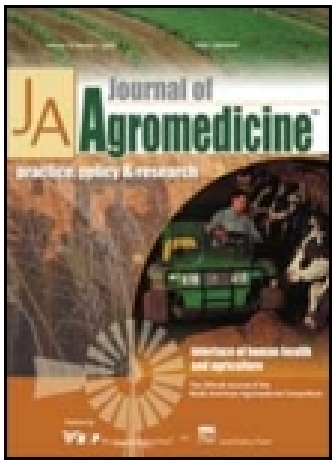

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Female Farmworkers' Perceptions of Heat-Related Illness and Pregnancy Health

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Female Farmworkers' Perceptions of Heat-Related Illness and Pregnancy Health

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ABSTRACT. Although agricultural workers have elevated risks of heat-related illnesses (HRI), pregnant farmworkers exposed to extreme heat face additional health risk, including poor pregnancy health and birth outcomes. Qualitative data from five focus groups with 35 female Hispanic and Haitian nursery and fernery workers provide details about the women's perceptions of HRI and pregnancy. Participants believe that heat exposure can adversely affect general, pregnancy, and fetal health, yet feel they lack control over workplace conditions and that they lack training about these specific risks. These data are being used to develop culturally appropriate educational materials emphasizing health promoting and protective behaviors during pregnancy.

KEYWORDS. Beliefs, farmworkers, heat-related illness, pregnancy health

INTRODUCTION

Rising temperatures attributable to global warming are quickly gaining attention as a serious threat to public health. Extreme heat events are especially problematic for vulnerable agricultural populations who are at increased risk of occupational heat-related illness (HRI). Most agricultural work occurs outdoors or within enclosed environments that are not well ventilated, such as greenhouses, potentially exposing workers to extreme weather conditions and/or humidity. From 1992 to 2006, 16% of all occupational heat-related deaths were related to crop production.[1] Twenty-one states reported these types of deaths, with 57% occurring in

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California, Florida, and North Carolina.[2] These cases are often underreported as heat stroke and go unrecognized at the time of death.[3]

In an agricultural environment, HRI occurs primarily when an increase in a worker's core body temperature exceeds the body's capacity to dissipate heat and maintain equilibrium.[4,5] Environmental, work-related, and individual risk factors work synergistically to increase farmworkers' susceptibility to HRI. Environmental factors at workplaces include climate conditions, such as high ambient air temperature, high humidity, and low airflow. Work-related factors include metabolic heat arising from work intensity, duration of heat exposure, and personal protective equipment and clothing worn while working.[6–9] Individual risk factors include preexisting health conditions, such as kidney disorders, metabolic disease, and cardiac arrhythmias; physical factors, such as body composition, cardiorespiratory fitness, and hydration levels; heat acclimatization status; nutrition; alcohol use; and medication use.[10–13]

Symptoms of HRI exist on a continuum, with categorical progressions that, if left untreated, lead to further physical decline.[14] The spectrum of HRI ranges from less severe forms of heat stress, such as swelling and cramps, to more serious manifestations of heat exhaustion and heat stroke, requiring immediate attention to reduce potential adverse health effects and in severe cases, death.[12,15] The less severe forms of HRI include *heat cramps*, which occur when sweating induced loss of electrolytes and salt initiates cramping in heavily used muscles such as the thighs, calves, and shoulders; *heat edema*, which occurs when blood pools in the hands or feet, causing them to swell; and *heat syncope*, which results when blood volume is reduced because of excess sweating, causing dizziness upon standing. A more serious HRI is *heat exhaustion*, which occurs when water or salt is depleted from the body, causing headache, nausea, vomiting, light-headedness, profuse sweating, and extreme weakness. *Heat stroke* is a life-threatening complication of HRI that can occur when the core body temperature rises above 40°C (104°F). Symptoms of heat stroke can include delirium, convulsions, and coma. It can cause permanent neurological damage and can even be fatal.[14]

In 2011, the US Department of Labor estimated 556,000 women were working in agriculture and related industries.[16] The latest report of the National Agricultural Workers Survey indicate that most farmworkers are of childbearing age; in 2007–2009, the average age was 36, and a quarter were younger than 25.[17] Although extreme heat has been recognized as an occupational hazard for those working in agriculture, studies examining the effects of occupational heat exposure on the health of female farmworkers and possible pregnancy-related complications are underreported in the literature. Pregnancy naturally elevates the body's temperature, placing women who work outdoors and in agriculture in high temperatures at increased risk for heat exhaustion and potentially harming the unborn child.[18] Of particular concern is the reported association between hyperthermia and neural tube defects.[19] Widely accepted limits for human maternal core body temperatures have not been established and the exact time and dose of heat that would result in teratogenesis is unknown; however, animal studies indicate that an increase in core body temperature of 2°C above normal and a gestational stage of 3 to 8 weeks may be related to teratogenesis.[20–22] Researchers have attempted to study the risk of birth defects among hot tub and sauna users, with inconclusive results. However, in a study to investigate tolerance to heat in hot tubs and sauna by Harvey et al., it was found that all of the women left the sauna and the vast majority of their participants left the hot tub due to discomfort before their core body temperatures reached 38.9°C (102.0°F).[20]

The extent to which female agricultural workers tolerate discomfort in the work setting may not be comparable to women in other studies, such as those with hot tub and sauna users. In the agricultural industries studied, wages are tied directly to production and these workers may push themselves beyond their heat tolerance limits to avoid losing pay. This article reports formative data from community-based participatory research (CBPR) with female fernery and nursery workers in Central Florida to learn

about their work practices, individual risk factors, and physiological response to working in hot environments.

MATERIALS AND METHODS

Setting: Nursery and Fernery Operations

For the purposes of this study, "nurseries" are defined as those companies producing a variety of ornamental plants, including cut flowers, flowering potted plants, hanging baskets, potted foliage, bedding and garden plants, and woody ornamentals. "Ferneries" are defined as companies producing cut ornamental foliage, such as that used as florists' greens. Both of these agricultural industries are prominent in Central Florida.

During certain months in Florida, ambient outdoor air temperatures can exceed 100°F. Work tasks involved in cultivating and harvesting nursery plants and ferns differ, but there are similarities in the work environments that can increase workers' susceptibility to HRI. Work in both industries takes place year round and occurs in enclosed environments where heat and humidity are retained and there is less air circulation. Additionally, workers may wear heavy clothing such as long pants, long-sleeve shirts, and plastic aprons, which can protect them from plants, water, and pesticides. As with other types of agricultural work, nursery and fernery workers are under pressure to meet certain production quotas, requiring rapid work and limited breaks. Rapid work requires physical exertion, which can increase perspiration, an important evaporative mechanism that dissipates heat and cools the body.[14,15] Yet high levels of humidity and heavy clothing can reduce the evaporation of perspiration; instead, fluid accumulates on the skin resulting in fluid losses, electrolyte imbalances, and a rise in body core temperature.[15,23] A more specific characterization of work in nursery and fernery operations is presented below.

Nursery Worker Community

Most nursery workers labor inside greenhouse structures constructed of nonporous heavy plastic (glass greenhouses are not as common in Florida). Work tasks are variable and may include planting at conveyor belts; loading pots of plants into trays; and loading and carrying trays, boxes, or bags of soil. All work tasks are performed to meet stringent time constraints and rigorous daily quotas. According to rough estimates, there are approximately 10,000 to 12,000 nursery/foliage workers in Central Florida. A 1990 agribusiness survey in Florida included a sample of 142 nurseries comprising a total of 3106 workers, 42% of whom were women. Eighty-two percent of these employees worked full time and women were as likely as men to work full time.[24] Nursery workers are primarily Hispanic, of Mexican origin, but there are also Hispanics from other countries, Haitians, and African Americans. A previous study with Florida nursery worker households showed that a majority of workers (71%) were married or cohabiting and about half (50.2%) had children in the household.[25] The sample of women who participated in the current study were representative of these general demographics.

Fernery Worker Community

Most fern cutters work in fields under black mesh shade cloth or large shade trees. To harvest ferns, workers bend over, thrust their arms into masses of ferns, cut fronds at their base, and secure them into bunches of 20 to 25 fronds. They leave the bunches on the ground until they have a particular quantity, then they gather up all the bunches into an armload, which they quickly carry to a trailer waiting at the edge of the field. The most experienced fern cutters can harvest up to 300 bunches of leatherleaf ferns a day. According to community-based estimates, there are an estimated 13,000 workers in the Central Florida fern industry. The majority of fernery workers are Hispanic, of Mexican origin. A previous study found that that a majority of fernery workers surveyed (76.2%) were married or cohabiting and a majority (64.9%) had children in the household.[25] The women who participated in the current study were reflective of these general demographics.

Data Collection

Community-based participatory research (CBPR) involves community-centered research activities that ultimately ensure interventions are culturally appropriate and sustainable.[26–28] Israel et al. define this research as a collaborative approach that involves community members, organizational representatives, and researchers in all aspects of the research process and focuses on the larger social, political, and economics systems that influence behaviors and access to resources necessary to maintain health.[29] Some of the key principles of the CBPR approach include the integration of knowledge and action for the mutual benefit of all partners; a co-learning and empowering process to attend to social inequalities; research that is cyclical and iterative; a view of health from both positive and ecological paradigms; and dissemination of findings and knowledge gained to all partners.[28] As a formative research activity, academic and community-based researchers conducted five focus groups with female nursery and fernery workers in order to enhance knowledge of attitudes and practices related to occupational risks and pregnancy health and to gather qualitative data that could help form a survey instrument. Focus groups have been used effectively with socially marginalized groups such as farmworkers as a means to elicit open-ended responses related to experiences, perceptions, behaviors, and knowledge, which provide greater depth and richness than quantitative data.[30–33]

Community-based researchers were staff members of the Farmworker Association of Florida, Inc. (FWAF), a grassroots community-based organization of more than 10,000 members who work primarily in the vegetable, citrus, mushroom, sod, fern, and foliage industries in 15 counties in Central and South Florida. Staff members received training in human subjects research prior to the study as well as training in focus group facilitation. FWAF members are approximately 94% Latino (predominately Mexican, Guatemalan, and Salvadoran), 3% Haitian, and 3% African American. Approximately 40% are women, and more than 2000 members are active in FWAF activities annually. FWAF works in communities composed of low-income, ethnic-minority, migrant, and seasonal farmworkers, many of whom are documented or undocumented immigrants, with little or no formal education, and who speak little if any English. The FWAF has been engaged in CBPR projects focusing on farmworker health issues for nearly two decades.

Participants were recruited by trained FWAF staff. The groups were held at times convenient for the workers. They were moderated and co-moderated by FWAF staff, who administered the appropriate institutional review board (IRB)-approved informed consent forms before the groups commenced. Two focus groups were conducted in Spanish with Hispanic nursery workers, one group was conducted in Haitian Creole with Haitian nursery workers, and two groups were conducted in Spanish with Hispanic fernery workers. Two additional researchers audio recorded all the groups, but were not present in the rooms where the discussions took place. A total of 35 women participated in all the groups. The majority were of Mexican descent ($n = 28$) and the remainder were Haitian ($n = 7$). The mean age of the participants was 38 (range: 18 to 55). Sixteen of the participants worked in ferneries and the remainder in nurseries. Each participant received a $25 gift card for their participation. After completion of each focus group, the two outside researchers debriefed the moderator and co-moderator on tape to capture their impressions of the groups' progress. All data collection protocols were approved by appropriate university institutional review boards.

Measures

Project team members developed a series of open-ended questions focusing on general worker health issues; general, pregnancy, and fetal health problems potentially related to pesticide exposure; physically difficult and repetitive work tasks and the impact of these tasks on pregnancy health; health problems potentially related to heat at the workplace; and means of protection against these types of occupational health risks. Preliminary questions were read to community members to ensure they were

understandable. The final questioning guide was translated into Spanish and Haitian Creole. Results related specifically to the topic of pesticide exposure have been previously reported.[34] This paper presents the results from questions specifically focused on heat exposure at the worksite.

Analysis

Tape recordings from each group session were transcribed in Spanish and Haitian Creole and then translated into English. Original translators viewed the English translations for accuracy and the English transcripts were cleaned and formatted for analysis. A list of code words representing the major topics of the focus groups was developed by the research team and transcripts were manually coded, blocked, and moved into files according to 24 different categories. The files were organized into a total of six general thematic inquiries. One of these inquires related most specifically to heat exposure: "How do workers describe heat related health issues affecting all types of workers and the means of treating and protecting against these problems?" Within this inquiry, the following code words were used to further categorize the data and identify major themes: *Heatgenhealth* (health issues related to workplace heat, not gender specific); *Heatpreghealth* (health issues related to the impact of workplace heat on pregnant women specifically); *Heatfetalhealth* (health issues related to the impact of workplace heat on a fetus, which can result in child health problems); and *Heatprotect* (general ways that workers can protect themselves against workplace heat).

RESULTS

The following qualitative results from focus group sessions describe four major themes related to heat exposure at the worksite and its potential impact on worker health: (1) general heat-related health effects; (2) effect of heat on pregnancy health; (3) effect of heat on fetal health; and (4) heat protection strategies.

General Heat-Related Health Effects

Occupational exposure to heat in nurseries and ferneries is of special concern because of the enclosed workplace environments. When asked what kind of health problems were experienced related to heat at the workplace, nursery and fernery workers mentioned similar symptoms. The most frequently mentioned problems were headaches, dizziness/fainting, respiratory problems, vomiting, and exacerbated high or low blood pressure. Less frequently mentioned were sunstroke and heart attacks.

> "*It is because of the heat that you can't see clearly. Sometimes I see a person walking, but I can't see his/her face. I can't distinguish them (when I have a headache).*"
>
> "*I understand heat. I never work late. When it is summer, I work less time. Why? Because I get dizzy, I vomit, have headaches. I have vomited in the fields, especially when it is real hot. All afternoon I was sick. It was only after night and after taking some medicine that I felt better.*"
>
> "*When the temperature is too high I suffer low blood pressure. Later I feel poorly, because we have to work very fast. Then there is a very high temperature and you are working a thousand miles per hour, my pressure goes down right away.*"

Workers mentioned other problems indirectly related to excessive heat. Excessive sweating, so much so that clothes were soaked through, was said to cause skin irritation, rashes, itching, eye irritation (when sweat runs into the eyes), and even vaginal infections. Prolonged heat exposure also lends to the potential of dehydration, which most workers realized they should address by drinking water. However, some workers reported they limited water intake so they would not have to take the time to go to the bathroom. Also, some workers felt that drinking cold water might cause heart palpations, vomiting, and pneumonia when their bodies were too hot from working.

> "*You get thirsty because the heat is very strong. Sometimes it is more than*

100 degrees under the shadecloth and at 100 degrees you want to drink more and more water. Your stomach gets very full, but you are still thirsty, but when you keep drinking and you are full you start to vomit."

Workers described how heat in combination with other climatic conditions could also lead to adverse health effects. When it is hot and dry, for example, the dust rises from the work area and causes eye irritation. When it is hot and raining or humid, many workers said they become drenched and suffer from "feverish chills," which leads to colds and bone aches.

"*In the summer there is always rain on us. Sometimes, when it is very hot, suddenly the rain comes and our bodies are hot . . . We suffer a lot of pain in our backs, in our bones, because we get wet when we are warm.*"

Effect of Heat on Pregnancy Health

Workers were asked how heat at the worksite could affect women who are pregnant or are thinking of becoming pregnant. The most commonly mentioned impact was that pregnant women working in extreme heat are more prone to dizziness and fainting. Workers also said that the heat can exacerbate a pregnant worker's preexisting low or high blood pressure issues. They also mentioned that pregnant workers may experience more nausea/vomiting, feverish chills, headaches, and sunstroke while working in the heat.

"*I asked my husband, when I was pregnant . . . 'When are we leaving? It is too hot.' He said, 'We are not leaving for awhile.' I sat at the edge of the field and I insisted, 'It is too hot, let's go.' He said, 'Just wait, you can sit there.' But it was too hot, and that heat makes you dizzy.*"

"*It was very hot. I felt feverish chills . . . I had headaches and everything and you feel dizzy and want to throw up because you are bent over while you are pregnant.*"

Effect of Heat on Fetal Health

Workers expressed varying perceptions about the impact of heat on a developing fetus. Many believed that heat can cause a fetus to become agitated, resulting in increased fetal movement and possibly increased fetal heartbeats. Some women said a fetus could "drown from heat" and others pointed out that if a woman becomes dehydrated from not drinking enough water in extreme heat, the fetus will also suffer dehydration.

"*I was working in the summer when I was pregnant. My baby moved a lot, he did not let me work. I talked to him: 'Relax, relax please, it is going to pass.'*"

"*I know a lady who was working while pregnant. She said that in the morning her baby was moving. It was very hot that day, by night the baby did not move anymore. He was dead. She did not feel any movement, he drowned from the heat.*"

"*I think it is transferred despair. Imagine, you are hot, the weather is hot, everything is hot and you are breathing in heat. You can imagine it is related to that.*"

Heat Protection Strategies

When asked how workers, and particularly pregnant workers, could protect themselves from the heat, many workers initially said there was no way to do this. After further reflection, some then said that drinking a lot of water or drinking Gatorade helped, as did wearing a hat (particularly a wide brimmed straw hat). Other suggestions were to take breaks, use a fan, and use sunblock. Some workers said pregnant women should stay home from work after a particular point in their pregnancy, or ask to work in areas at the worksite where there is less sun exposure.

"*I think there is no way to protect ourselves from the sun. Where we work is in the fields, they have black shadecloth and all is closed in. It is impossible. It does not matter if you use a hat and you are drinking water. There is no way to protect*

you from that intense heat—unless you are in the middle of the forest, where there is more wind."

"*A palm hat is not hot and it blocks the sun very well. I drink a lot of water or Gatorade because that helps a lot. At noon, when you start to feel bad, I would stop working and rest for awhile.*"

DISCUSSION

Although all farmworkers are susceptible to HRI, some may be more susceptible due to individual factors, including pregnancy, age, body mass index, and predisposing chronic conditions. Documented accounts of severe cases of HRI among farmworkers confirm the persistence of this occupational hazard. In May 2008, Maria Isabel Vasquez Jimenez, a 17-year-old female farmworker, was pruning grapevines in San Joaquin Valley on a day when temperatures exceeded 95°F. She collapsed and supervisors recommended that she be taken to rest in a hot van and revived with rubbing alcohol. She was taken to a medical clinic nearly 2 hours after she collapsed and died 2 days later. After her death, doctors discovered she had been 2 months pregnant. The company that hired her was later fined for violating eight workplace safety rules, including failure to provide water and deliberately neglecting to train workers about heat safety.[35] Sadly enough, the case of Maria Vasquez was not an isolated event, similar heat-related incidents among farmworkers have been documented in other states.[1]

The General Duty Clause, Section 5(a)(1) in the Occupational Safety and Health Act of 1970 (OSH Act), requires employers to provide a workplace free from recognized hazards likely to cause death or serious physical harm. The US Department of Labor and Occupational Safety and Health Administration (OSHA) have recognized the threat that high temperatures pose for workers and have launched a nationwide outreach campaign to raise awareness about the hazards of working outdoors in hot weather.[36] The campaign attempts to identify workers at risk and provide education regarding HRI symptoms and care needed to prevent serious complications. A free mobile phone application allows workers and supervisors to enter the temperature and humidity, calculate the heat index for their worksite, and receive a consequent risk level to outdoor workers. Based on the risk level, the application provides a recommendation for protective measures such as drinking enough fluids, scheduling rest breaks, planning for and knowing what to do in an emergency, adjusting work operations, gradually building up the workload for new workers, training on heat illness signs and symptoms, and monitoring each other for signs and symptoms of HRI.[36]

Yet, these efforts are only advisory and do not constitute a new standard or regulation. Two states, recognizing the risk to workers in their states and the optional nature of the federal guidelines, have developed additional guidelines. In 2006, California adopted a heat-stress regulation that requires employers to provide workers with written procedures and training, 8 ounces of fresh water each hour, and access to shaded or cool areas. Washington also has an emergency heat-stress rule designed to protect outdoor workers that includes providing a quart of drinking water per hour, shade or air conditioning, and education about HRI.[37]

The risk of HRI is expected to increase if global temperatures continue to rise. The United Nations Intergovernmental Panel on Climate Change indicates that year round temperatures will increase from between 1°F and 5°F across most of North America during the 21st century.[38] During the summer of 2012, temperatures climbed above 100°F throughout midwestern and eastern states. Climate change will affect human health in many ways, including increasing the incidence of HRI. Indeed, data indicate that heat-related deaths may be increasing among crop workers and the issue of outdoor workers increased vulnerability to HRI has become increasingly important.[39] Given that mandatory, uniform regulation does not exist to ensure farmworkers are provided the water, rest, and shade needed during periods of elevated temperatures, many farmworkers must care for themselves or be at high risk for HRI. Research with farmworkers and pesticide exposure indicates that perceived control in the workplace was strongly related to safety knowledge and safety behavior.[40] It is likely that similar perceptions of control would motivate

safety behavior related to HRI, yet none of the women in the focus groups indicated that they had received training specific to the hazards of heat exposure. Furthermore, other common workplace conditions and behavior could actually increase the risk of HRI. For example, worksites differ in terms of the accessibility to clean drinking water and workers sometime avoid taking breaks because wages are based on production volume.

Despite the general acknowledgement of increased HRI risk for farmworkers and the national attempts to highlight this hazard, there are no specific educational materials for pregnant workers and there have been no studies assessing the specific needs of pregnant farmworkers in preventing HRI. The qualitative data presented here are a first step in promoting prevention of HRI because they document female farmworkers' beliefs about heat exposure and pregnancy outcomes upon which further study can build. Female farmworkers consistently believe that heat exposure can adversely affect general, pregnancy, and fetal health, yet they indicate a lack of control over the conditions and receive no specific training about HRI, especially as it relates to pregnancy health. A lack of training may make it difficult for women to recognize the symptoms of HRI and differentiate them from other possible causes producing similar symptoms, such as pesticide exposure, flu, or—for pregnant women—morning sickness. These data enhance our knowledge and insight on how to better address heat as a specific occupational hazard in this population.

The research team used these focus group data to develop a large community survey on occupational health risks and pregnancy outcomes. Culturally appropriate educational materials emphasizing health promoting and protective behaviors during pregnancy have been developed and will be disseminated to farmworkers and the health and scientific community. Future study will include characterizing the fernery and nursery environment while exploring the relationship between individual attributes, incidence of HRI symptoms, and physiological responses to heat stress. Plans include using an ingestible temperature sensor (CoreTemp; HQinc, Palmetto, FL) that will closely approximate core body temperature through measuring intestinal temperature[41] and classifying the intensity of work activities through accelerometry to characterize personal sources of metabolic heat while also recording heart rate throughout the workday during a high-heat-hazard study period. These data will help direct prevention strategies that can be used to improve the working conditions of this vulnerable population and will provide insight on interventions that can be employed in nonoccupational populations.

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